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CONTENTS

INTRODUCTION | 9

Engaging God through All Things

LECTIO SCIENTIA: The Spiritual Discipline of Scientific Knowing

CHAPTER 1 | 23

Radiation Therapy and the Empirical Mind of God

Foreword: Jacob Van Dyk, Medical Physicist

LECTIO SCIENTIA: Experiencing the Empirical Mind of Christ

CHAPTER 2 | 39

Supernovae and God's Passion for Matter

Foreword: Deborah Haarsma, Physicist, Astronomer

LECTIO SCIENTIA: Making Matter Matter More

CHAPTER 3 | 53

Engaging God's Providence through Knees and Fossils

Foreword: Laurie Hiemstra, Orthopedic Surgeon

LECTIO SCIENTIA: Increasing Your Providential Awareness

CHAPTER 4 | 73

Sensing God's Presence via a Giant Squid

Foreword: Matthew Morris, Biologist

LECTIO SCIENTIA: Waking Your Senses

CHAPTER 5 | 91

Tree Branches, Wound Healing, and an Interdependent God

Foreword: Vern Peters, Biologist

LECTIO SCIENTIA: Upping Your Relational Intelligence

CHAPTER 6 | 111

Language Acquisition and a Multilingual God

Foreword: Ross Hastings, Chemist, Theologian

LECTIO SCIENTIA: Moving from Knowing to *Knowing*

CHAPTER 7 | 131

God's Beauty in DNA Repair Mechanisms

Foreword: Dustin Pearson, DNA Researcher

LECTIO SCIENTIA: Experiencing Beauty More Deeply

CHAPTER 8 | 149

Naming Creation via Neuroscience

Foreword: A Neuroscientist

LECTIO SCIENTIA: Knowing God in the Naming

CHAPTER 9 | 171

God's Hydrological Heart in a River

Foreword: Masaki Hayashi, Hydrologist

LECTIO SCIENTIA: The Chemistry of Creation Care

EPILOGUE | 189

God's Vision for Creation

Acknowledgments | 193

Notes | 195



CHAPTER ONE

RADIATION THERAPY AND THE EMPIRICAL MIND OF GOD

A Word from Jacob Van Dyk

WORKING IN A CLINICAL, cancer-therapy environment, where science applications span multiple disciplines, including medicine, physics, biology, engineering technology, and computer science, a person gets to interact with people of multiple backgrounds with a variety of beliefs and faiths.

One of my close colleagues of many years, as well as being one of the very prominent medical physicists in the international scene and a recipient of the Order of Canada, has written in his autobiography, “I don’t feel I have a religion, at least not in the sense of just accepting something that someone wrote down—someone who lived long ago and had much less knowledge about the world and the universe than we have. . . . Is there a God? Not of a personal kind anyway! If we are to have a good world, we have to make it so ourselves.”¹ Another one of my professional colleagues, who also is well known for the foundational medical physics text that he has written, also wrote a book in his retirement, in search of his “scientific and religious view of creation.” To quote, “The most difficult problem with all religions is their embrace of supernaturalism without question. God is

supernatural.”² His conclusion: “Do not take a chance on blind faith. Do not take a shot in the dark. Use your head. If you are convinced in your mind that your religion is the correct one for you, then love it and cherish it. Call it a gift from your God.”³

These are documented perspectives on faith and religion within my professional circles. Clearly, there are other perspectives. John Van Sloten writes elegantly here on science, radiotherapy, and the treatment of cancer. His starting point is that there is a God and that our experiences in our quest for advancing science, technology, and medicine reflect the mind of God. I have been raised from childhood in the Christian faith. I have struggled in my life with the understanding of God and how He influences my daily actions, my decision-making, and my shared life with my wife and children. I have reflected on many of the scientific arguments for and against the existence of God. I have concluded that science, on its own, cannot explain the origin of life. Thus, there must be a greater being who created life and the universe as we know it.

The Bible expands on this truth, both in the Old and New Testaments, with many facts shown to be historically correct. While that does not mean every word and concept are historically proven, or should be interpreted literally, it does demonstrate that a supreme being is involved in this world and in our personal lives. I, for one, feel very blessed.

I can look at my life and see influences that are expressions of a God who is involved. Whether other people would say that about their lives is a very open question. Certainly, there are circumstances in people’s lives where individuals feel alienated and alone. To me there is no simple answer to these issues other

than that we live in a world impacted by complex circumstances as well as by our own decisions and actions.

So how do I see the mind of God in my professional domain? The world is ordered according to fundamental laws and physical, chemical, and biological processes. This created order reflects the mind of God. It is up to us as humans to uncover (or discover) this order to advance our knowledge. As our knowledge advances, we have the potential to reduce the impacts of ill-health and improve our quality of life. Each discovery, each advancement, each new technology, each improved diagnostic procedure, each new computer software package, each improved radiation treatment technique, each improved understanding of human biology, each positive clinical trial, provides another stepping stone in reflecting the makeup of this world and everything in it, which in turn reflects the mind of God.

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RADIATION THERAPY AND THE EMPIRICAL MIND OF GOD

*GOD knows what's going on.
He takes the measure of everything that happens.*

1 SAMUEL 2:3 MSG

Several years ago, a woman with late-stage cancer approached me and suggested I preach a sermon on radiation physics. She'd been undergoing treatment and was fascinated by the technology. She saw it as a healing gift and wondered what radiation therapy could tell us about God. I was intrigued but also daunted by such a complex topic.

Later that same week I received an email from my friend Jake Van Dyk, who was in town and wanted to catch up. I knew he was a physicist but had no idea then that he'd literally written the book on radiation physics—*three* textbooks (at that time), actually. Perfect timing—he could help me with the science for my sermon, and I could introduce him to a new theological take on his work.

As we spoke about radiation therapy, I began to better understand the mind of a medical physicist (and a scientist in general). Jake had

always been good at physics and math in school and at any rationally structured course. A keen observer with a questioning curiosity, he wanted to know how things worked. He was organized, reasoned, and clear-thinking. To him, good science had to make a practical difference. His capacity to assess and measure came naturally—as did quantitative analysis. His well-developed ability to process large quantities of data enabled him to tackle complex questions. He took all the time needed to get to the right answer. He was good at seeing patterns. His love for teaching ranged from one-on-one interactions to writing textbooks. To Jake, knowledge was a gift to be shared. He loved research and analysis and wanted to do his part to help people with cancer and improve healthcare.

Engaging Jake’s empirical aptitudes, I began to catch glimpses of the mind of God. God clearly understands how things work. Divine reason holds the cosmos together. God sees, measures, and knows and has an infinite capacity to process data, recognize patterns and make every connection. God is rational—and good at math.

When a scientific mind is fully itself in all these ways it reflects God’s mind and—more than that—the scientific mind is close to its Maker. Physicist John Polkinghorne writes, “There is a remarkable congruence between the experienced rationality of our minds and the perceived rationality of the world around us.”⁴ Rational experiences, it seems, are made for a rational universe. When the two come together a scientist can experience the presence of God.

A scientist’s gratification in discovering a pattern is connected to God’s gratification in *creating* that pattern. The rational satisfaction of understanding how something works is akin to the rational satisfaction of having *made* that thing work. When science empirically engages a reality that was empirically conceived, it really does appear to be thinking God’s thoughts after God. In those moments, the mind of the Maker can be rationally experienced.

Near the end of my conversation with Jake, my physicist friend, another facet of his work reminded me of Christ. A medical physicist stands between science and technology. They bring the two together, speak both languages, and enable a healing synergy. Hearing him describe the mediating nature of his work caused me to recall the mediating nature of Christ.

I asked Jake if he'd ever experienced Christ in that place of meditation—not morally or ethically but scientifically, rationally, or technologically. His simple answer was yes. Because he was convinced that God made everything, every time Jake learned something new, he thanked God. When the new information led to improved patient outcomes, Jake recognized the love of Christ at work.

I probed more deeply, asking Jake if he'd ever experienced the *empirical* mind of Christ in a rational, scientific moment. At first, he equated the word *experience* with an emotional engagement of God. I could tell that—as a scientist—this was not his primary means of engaging reality. But experience doesn't always have to be emotional. We spoke about recognizing Christ in rational ways, and Jake told me about a spiritual experiment he'd once tried. Years earlier he'd read a book titled *Space for God*, which suggested building into your schedule reminders of God's presence in your life.⁵ Jake set his watch to beep every hour. Every time he heard the beep a Bible verse ran through his head, "Be still, and know that I am God" (Ps. 46:10). Wherever he was—in a meeting, at a hospital, or reviewing new technology—he would have a timely reminder of who was in charge. This simple experiment had a deep impact on his practice of faith.

God has filled every second of cosmic time with reminders. The Spirit moves everywhere. According to the Scriptures, the Spirit gives spiritual gifts to God's people, including wisdom and knowledge. In reference to Solomon's wisdom, the Bible says, "He could speak with authority about all kinds of plants, from the great cedar of Lebanon to

the tiny hyssop that grows from cracks in a wall. He could also speak about animals, birds, small creatures, and fish” (1 Kings 4:33 NLT).

Scientific wisdom is God’s wisdom. When a scientist experiences an innately scientific moment—learning something new, noticing a pattern, designing an experiment that yields good results, or talking knowledgeably about plants—there is an opportunity to be still and know that God is God.

FROM RATIONAL TO RELATIONAL

If science images a rational God and scientists are made to empirically experience God in moments of rational resonance, what would those moments of resonance look like? How would an empirically oriented mind, engaging an empirically generated world, *experience* the empirical mind of God? What steps could one take to transform these science moments into God-knowing moments?

To start, you would need to take God’s omnipresence seriously. If God is everywhere, then God is present to every rational scientific moment. If you believe in a personal God, then it’s reasonable to conclude that God can be known in any given moment. The God of the Bible listens and speaks and can be spoken to and listened to. While the lines of communication are not what they used to be—our capacities to engage God fall short—they haven’t fallen away completely. Since God is the author of both creation and the Bible, and since God makes revelation through creation clear through knowledge gained through biblical revelation, we should expect to see similarities between these two patterns.

The process of discovering these patterns might play out something like this:

A scientist is caught by something of interest and wonders how it

works. In that moment, believing in a personal God who is there, the scientist asks, “What is it that You already know about this, God?” This deferential stance affirms God’s attending presence.

Then the scientific seeker creates a hypothesis—a tentative explanation for what he or she is observing, an explanation that will be tested and further researched by ongoing study. In generating such a hypothesis, scientists of faith are essentially saying, “I think this is what You’ve done, God.” In that moment of faith, they open themselves up to a possibility. By opening themselves up to a possibility, they open themselves up to the possibility of glimpsing God.

Next, an experiment is designed that will, scientists hope, gather the best information possible. A scientific search is like a spiritual search; both are pursuing answers. With every experiment, science measures and tests what it thinks might be true. The empirical questions posed are akin to the faith questions the New Testament’s seekers asked the incarnate Jesus: *Who are You? What is God like? How does God operate?* When these questions are posed in the lab however, they are addressed to the *Creator* Jesus.

The scientists then gather and collate all the data—in their minds and on their hard drives. Like Jesus’ followers (who observed what Jesus did, how God worked through Him, what His parables meant), the scientists take all they’ve observed (what this protein does, how this subatomic particle works, how this molecule responds) and compile and sort it. They try to make sense of all the information they’ve been presented with.

Then the scientists begin to notice a path, structure, or way of being. As they experience that “aha” moment, the pattern of their

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As scientists discover something about the physical nature of the universe, they encounter the One who conceived of it in the first place.
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thinking falls into sync with the pattern of Christ's thinking. As they come to know something about the physical nature of the universe, they encounter the One who conceived of it in the first place. The Creator is right there, with them, within them, before them, before the creation of the world.

Finally, the scientists test their conclusion. Knowing that truth stands up to scrutiny, they send their findings out for peer review (even as they understand their thesis will continue to be tested by further scientific experimentation). If, over time, their conclusions are communally affirmed, then their best understanding of God's "new scientific word" goes out to all the world. When this happens, the scientist's feeling of scientific satisfaction echoes the same eternal satisfaction God expressed when He declared over His creation, "It is good."

WHEN RADIATION THERAPY IMAGES GOD

Radiation therapy images God. Radiation therapy comes from the imaginations of image-bearing scientists, technologists, and health-care practitioners. God made their empirical minds, their passions to make the world a better place, and their capacities to get the job done. Whenever a tumor is eradicated, we can literally thank God. And if you look closely, you'll see that the nature of radiation therapy reveals something about the nature of God.

Radiation therapy is multi-disciplinary.⁶ It brings science, technology, and medical practitioners together. It was one of the earliest sub-disciplines to use computers for dose calculations and imaging. Because of the influence of science, radiation therapy is one of the first medical disciplines to introduce clinical trials. Radiation therapy is built on physics, math, geometry, and biology.⁷ It synergistically combines knowledge from each of these fields to wield the "invisible

knife”⁸ of radiation treatment as precisely as possible. Without good technology, complex algorithms, a deep understanding of particle physics, or the practical sensibilities of a physician, radiation therapy could not do what it does.⁹ When a field of medicine draws this broadly from what God has made, it points to the imaginative breadth of God’s healing mind.

God draws from an infinite number of resources to heal brokenness. When we see the breadth of human ingenuity in the healthcare system come together, we’re glimpsing something of the fullness of God’s omniscient power. The psalmist wrote, “The earth is the LORD’s, and everything in it, the world, and all who live in it” (Ps. 24:1). Everything in the Lord’s earth includes physics, physiology, and linear-accelerator technology.

Another unique God-imaging facet of radiation therapy is its precise geo-spatial nature. “In its simplest form, the aim of radiation therapy is to cure the tumor without harming the patient.”¹⁰ Over the past few decades, science and medicine have worked with ever-increasing precision to irradiate tumors with minimal damage to surrounding healthy cells. The history of this field of medicine chronicles the development of better and better imagery (to identify the scope of the tumor) that then enables more focused radiation dosing.

When radiation therapy began, there was only 2D X-ray imagery. Then came 3D CT scanning followed by IMRT (intensity-modulated radiation therapy). Next came IGRT (image-guided radiation therapy) with imaging capacities built into the machines. And now 4D imaging has been developed, which adjusts the targeted radiation beam to work in time with a patient’s breathing, keeping the treatment moving with the tumor. In the future there will be 5D imaging, which will take into account a patient’s unique biology, watching how the individual reacts to treatment in real time and tailoring the treatment to a person’s particular genetic

makeup. All this increasingly accurate dosing happens while the radiation beam rotates *around* the patient, to minimize collateral cell radiation exposure.¹¹

When you glimpse the glory of all this empirical precision, it's hard not to fall to your knees. God sees what's wrong and treats the problem more precisely than the best radiation treatment imaginable—and does so with minimal collateral damage (despite our temporal sufferings).

Like the best imaging technology, God sees from every angle and dimension. When physics, math, computing, and biology come together in radiation therapy, we get a glimpse of the all-seeing mind of God described in Scripture: “God knows what’s going on. He takes the measure of everything that happens” (1 Sam. 2:3 MSG).

Whenever physicists, software engineers, technologists, or physicians play their part in facilitating radiation therapy—using their empirical sensibilities to full capacity—they are doing the rational, restorative work of God in the world.

Through the God-imaging empirical actions of these scientists, a holy wisdom is moving—the work of a divine, rationally resonant Presence, a Presence who wants relationship as much as He wants the eradication of cancer. This is who Christ is. He drew near to us so we could draw near to God—with all our hearts, souls, minds, and vocational acts.

What's amazing is that God accomplishes this *in* us even as God works *through* us to help others. Through the body-renewing work of radiation therapy, God renews the minds and hearts of scientists, technologists, and doctors—enabling them to become more fully themselves. As technologies develop, we develop. Better science gives us more capacity to do better science and gives us more empirical resonance with which to engage the mind of God.

Again, the more we work to understand the mind of God, the

more we can be changed into God's likeness, making us more like Christ!

BUT CANCER KILLS

A few months after telling my friend with cancer that I was going to preach on radiation therapy, I sat beside her hospital bed and held her hand. Her treatments had been ineffective. Death was near. Praying for peace, we felt God in the room. God was in that room—mysteriously through the presence of the Spirit and practically through all the medical history and technology that made up the hospital we were in.

God uses science to heal, but science is limited. Like all created things, it falls short. Science cannot see perfectly or act with total precision. Only God is that perfect and precise. Only God can imagine the full scope of all that is needed to make all things well.

The beauty of experiencing God's empirical presence is that it comes with a big dose of hope: "This is what the LORD says, he who made the earth, the LORD who formed it and established it—the LORD is his name: 'Call to me and I will answer you and tell you great and unsearchable things you do not know'" (Jer. 33:2–3).

Jesus wants scientists to know how He thinks. He wants them to meet Him in the reasoning process. He wants them to know the mind of Christ—spiritually, ethically, and rationally.

If all things were made through Jesus, then clearly Jesus is fluent in physics, chemistry, and biology. In a very real sense, these languages are His native tongue. When humanity engages them,



When scientists attend to creation, they're listening to how Christ thinks.



God's world-ordering mind can be known through our rationally comprehending nature.

When scientists attend to creation, they're listening to how Christ thinks.

Science rationally observes, asks the right questions, and draws reasonable conclusions based on the evidence. Science wants the truth, the whole truth, and nothing but the truth. It is precise, economic, well ordered, and efficient. Science is driven to get it right when it comes to understanding reality—a reality God already understands. Both God and science want our world to reach its potential. To enable this, God gave science an innate capacity to rationally think God's thoughts after God.



LECTIO SCIENTIA

Experiencing the Empirical Mind of Christ

This chapter asks, “How would an empirically oriented mind, engaging an empirically generated world, *experience* the empirical mind of God?” The response is a step-by-step scenario detailing how a scientist of faith might engage God more deeply.

What works for a scientist of faith can also work for any empirically minded person as they engage the ongoing work of science. Every empirically resonant moment that plays out in the news today is an opportunity for a rationally attentive Christian to experience the empirical mind of God.

PRACTICE

Consider engaging the steps science takes as an opportunity to know God more.

What if when you read of a scientist expressing interest in how something works, you say to yourself, “You already know how it works, God. By even wondering about the nature of reality, this scientist is giving evidence of You. You created empirical curiosity and attentiveness. Their passion points to You.”

When you hear a scientist describe how they went about generating their hypothesis (their questions and hoped-for answers), let the moment be a reminder of a God whose thoughts are not your thoughts, whose ways are above your ways. In humble incredulity, acknowledge the deeply insightful, prophetic nature of science, which raises questions most of us would never know to ask.

Acknowledge that even as God surely smiles when scientists better understand and appreciate the world, God also smiles when any of us better understand *any* facet of reality—relational, artistic, educational, or economic. Whenever we better understand how things work, God is glorified (whether we glorified Him on purpose or not). When science knows more through *its* means of truth-seeking, we can be encouraged to know God more through *all* means of truth-seeking. Science’s constant questioning gives us permission to question.

As you take note of how science follows the data—accumulating it and discerning patterns—be reminded that you can observe your life in a similar way. Based on the evidence, life is often much better than we give it credit for. Whenever we consider what we’re thankful for, we realize a surprising truth: life is mostly good most of the time. When science follows the data in a trustworthy way and discerns a true pattern, let it be a reminder of what is trustworthy and true in your life—God’s good and greater pattern.

You can even learn to trust God through science’s failures. Even with all our advances, science still falls painfully short. People die of cancer. Discoveries are used for nefarious purposes like atomic bombs or eugenics. Healthcare is commoditized, putting profits over people.

Researchers hoard their data or hide it behind paywalls. Competition undermines cooperation. Like all of humanity, science's sinful propensities remind us of the still-unhealed brokenness of our human condition.

Through the Old Testament prophet Isaiah, God said,

“For my thoughts are not your thoughts,
neither are your ways my ways,”
declares the LORD.

“As the heavens are higher than the earth,
so are my ways higher than your ways
and my thoughts than your thoughts.” **ISA. 55:8-9**

Isaiah's words are true in terms of what science can claim to empirically know about the nature of reality. They're also true in terms of the nature of human hearts. God's ways are beyond ours. God sees the whole picture, from all eternity. Our Maker's plan, based on the patterns of Scripture and creation and the ever-evolving gift of science, is to one day make all things new, to have a world where everyone knows God through all things. Centuries of scientific advances fit within this greater plan. If we can stand back far enough, the pattern will become clear.

Imagine engaging God through all the steps that make up the scientific method. Next time you read a compelling science news story, look past the empirical details to see the Empirical Mind behind the story. Go deeper. Let the empirical Spirit of Christ lead the way.

PRAY

Lord, give me eyes to see Your mind reflected in the mind of a scientist. Help me recognize the patterns You've put in place. Connect my reason to Yours. Make me curious for You. Be the answer to all my questions.

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